CHAPTER 4

WATER POLLUTION CONTROL PROGRAMS

POINT SOURCE CONTROL PROGRAM

Wastewater Treatment Facility Permitting

Point source pollution refers to any discharge from municipal or industrial facilities that can be identified as emanating from a discrete source such as a conduit or ditch. Kentucky has a total of 6,650 facilities covered by the Kentucky Pollutant Discharge Elimination System (KPDES) program. In addition, new federal mandates require expansion of the point source program to include stormwater runoff.

Wastewater permit limits in Kentucky have been water quality-based since National Pollutant Discharge Elimination System (NPDES) program delegation on September 30, 1983. Generally, there are two approaches for establishing water quality-based limits for toxic pollutants: (1) chemical-specific limits, meaning the use of individual chemical criteria (which are derived for the protection of aquatic life) for determining discharge limits for all known toxic or suspected toxic pollutants in an effluent; or (2) whole effluent toxicity testing, which sets limits on an effluent's total toxicity, as measured by acute and/or chronic bioassays on appropriate aquatic organisms. Both approaches have advantages and drawbacks, but when both are integrated into a toxics control strategy, they provide a flexible and effective control for the discharge of toxic pollutants.

Toxicity data are available for only a limited number of compounds. Single parameter protection criteria, therefore, often do not provide adequate protection of aquatic life where the toxicity of the components in the effluent is unknown, where there are synergistic (greater than predicted) or antagonistic (less than predicted) effects between toxic substances in complex effluents; and/or where a complete chemical characterization of the effluent has not been carried out. Since it is not economically feasible to determine the toxicity of each of the thousands of potentially toxic substances in complex effluents or to conduct exhaustive chemical analyses of effluents, the most direct and cost-effective approach to measuring the toxicity of effluents is to conduct effluent toxicity tests with aquatic organisms. By the end of 1989, Kentucky had incorporated biomonitoring requirements into the permits of 66 municipal wastewater treatment plants and 35 industrial wastewater facilities.

The quality of Kentucky's surface waters continues to face a threat from improperly treated industrial waste discharged into municipal sewage treatment systems. Such waste often contains pollutants that are either not removed by the municipal treatment process or, if removed, result in the generation of contaminated sludge. In an effort to control this problem, Kentucky has approved pretreatment programs in 64 cities and has screened several others to determine their need for a pretreatment program. A list of communities with approved pretreatment programs and the estimated costs to administer the local program is presented in Table 34. The facilities needing programs are all on schedule for obtaining approval. Once approved, each program is inspected annually and must submit semi-annual status reports to the Division of Water for review. These reports are incorporated into the computer files known as the Permit Compliance System (PCS) and Pretreatment Permits and Enforcement Tracking System (PPETS).

Municipal Facilities

The Construction Grants Program has resulted in the construction of $57.8 million in wastewater projects which came on line during 1988-1989 as indicated in

Table 34
Total Estimated Level of Annual Funding Required to Implement the POTW Pretreatment Program

No.	City	$/year
1.	Adairville	6,250
2.	Ashland	73,000
3.	Auburn	2,300
4.	Bardstown	20,000
5.	Beaver Dam	12,750
6.	Berea	10,000
7.	Bowling Green	75,000
8.	Calhoun	in-active
9.	Calvert City	20,000
10.	Campbellsville	45,000
11.	Campbell/Kenton Co. SD #1	85,000
12.	Corbin	14,600
13.	Cynthiana	250
14.	Danville	8,500
15.	Edmonton	5,000
16.	Elizabethtown	115,000
17.	Eminence	5,200
18.	Frankfort	29,000
19.	Franklin	30,000
20.	Fulton	16,000
21.	Georgetown	10,000
22.	Glasgow	30,000
23.	Guthrie	16,000
24.	Harrodsburg	25,000
25.	Hartford	1,000
26.	Henderson	70,000
27.	Hopkinsville	154,000
28.	Horse Cave	10,000
29.	Jamestown - Russell County	30,000
30.	Jeffersontown	60,000
31.	Kevil	100
32.	Lancaster	4,000
33.	Lawrenceburg	16,000
34.	Lebanon	7,100
35.	Leitchfield	20,200
36.	Lexington	189,000
37.	Livermore	1,500
38.	London	6,500
39.	Louisville MSD	896,900
40.	Madisonville	30,000
41.	Marion	3,100

Table 34 (Continued)

No.	City	$/year
42.	Maysville	12,000
43.	Middlesboro	9,000
44.	Monticell	in-active
45.	Mount Sterling	12,000
46.	Murray	9,000
47.	Nicholasville	31,000
48.	Owensboro	49,000
49.	Owingsville	500
50.	Paducah	81,200
51.	Paris	30,000
52.	Princeton	12,000
53.	Richmond	23,800
54.	Russellville	5,000
55.	Scottsville	1,500
56.	Shelbyville	13,000
57.	Somerset	75,000
58.	South Campbell County	in-active
59.	Springfield	500
60.	Stanford	1,100
61.	Tompkinsville	in-active
62.	Versailles	8,000
63.	Williamstown	6,350
64.	Winchester	40,000
	TOTAL	2,573,200

Table 35. Twenty-one municipal wastewater projects were completed during this two year period. An additional 20 projects are in various stages of construction.

Significant improvements in water quality have been realized through the construction of new wastewater treatment facilities. A review was made of facilities completed during 1988-1989 which had discharges to surface waters. The discharge monitoring reports indicated significant reductions in pollutants.

Although significant improvements in water quality have been realized through the construction of new wastewater treatment facilities, there are numerous needs that remain to be addressed. The 1988 Needs Survey, conducted by the Division of Water as part of its planning process, indicated that municipal dischargers continue to impair water quality and pose potential human health problems. State and federal minimum treatment requirements are not being met in every instance. The 1988 Needs Survey identified a capital investment need of $1.11 billion to construct and rehabilitate wastewater treatment facilities and components for Kentucky, based on the 1988 population. Backlog needs of $1.11 billion, coupled with long-range needs for publicly-owned treatment facilities, reveal a projected total need of over $1.46 billion through the year 2008. A detailed breakdown of investment needs is presented in Table 36.

Table 35
Construction Grants Funded Projects Which Came on Line
During Calendar Years 1988-1989

	Date on Line	Design Flow (MGD)	Treatment Cost	Interceptors
Ashland	6/89	11.000	$16,013,289	$2,651,277
Radcliff	2/88	2.800	$ 5,137,510	$3,077,836
Lancaster	9/89	1.00	$ 1,663,500	$ 149,700
Leitchfield	4/88	1.300	0	$ 75,866
Springfield	6/88	0.464	$ 3,009,242	$ 184,224
Paintsville	5/88	0.993	$ 4,712,733	$ 115,670
Dawson Springs	9/89	0.320	$ 2,415,522	0
Fulton	9/89	0.720	$ 1,411,165	0
Hodgenville	7/89	0.289	$ 2,367,170	$ 287,551
Stanton	1/89	0.460	$ 1,816,234	0
Owenton	9/89	0.150	$ 1,916,836	0
Hardinsburg	6/89	0.110	$ 1,972,539	$ 792,284
Lancaster	6/88	0.375	$ 762,628	$ 140,081
Elkton	5/88	0.250	$ 1,319,062	$ 984,795
Vine Grove	3/89	0.714	$ 2,937,631	$1,288,704
Hanson	5/88	(Sewers)	0	$ 327,169
Taylor Mill	1/89	(Sewers)	0	$ 250,000
Totals			$47,455,061	$10,325,157

Table 36
Investment Needs for Wastewater Treatment
Facilities in Kentucky
1988-2008
(In January 1988 millions of dollars)

Facility	For Current 1988 Population	Projected Needs 2008 Population
Secondary treatment	$ 137	$ 185
Advanced secondary treatment	$ 50	$ 60
Infiltration/Inflow	$ 78	$ 78
Major rehabilitation of sewers	$ 12	$ 12
New collector sewers	$ 544	$ 671
New interceptor sewers	$ 264	$ 428
Correction of combined sewer overflows	$ 23	$ 23
Total	$1,108	$1,457

The 1986 305(b) Report to Congress described Kentucky's Water Infrastructure Report and concluded that a revolving loan fund concept was the most feasible option for Kentucky in meeting its water infrastructure needs. Because the federal law was not in place at that time, Kentucky was unable to pass appropriate legislation during the 1986 Kentucky General Assembly.

When the 100th Congress of the United States passed HR 1, this initiated the final steps toward establishment of state revolving funds. States were given the option of using a portion of the allotment for grants through FY 90. Kentucky made the decision to place all federal dollars in the revolving fund to the extent possible beginning in FY 88. A few large segmented grant projects require continuation of grant funding through FY 90. An early transition from grants to loans will assure more available dollars in the revolving loan fund over the long term.

Kentucky state legislation was passed March 14, 1988. Kentucky has received two capitalization grants from EPA. These grants of FY 88 and FY 89 federal funds total $33.2 million. Provisions have been made in the state biennial budget for the 20 percent match, and it is estimated that approximately $147 million will be available in federal and state funding through 1994 when federal funding is to cease. This should be a first step toward funding the $353 million of requests contained in the state's priority list, plus other wastewater needs which have not yet been placed on the priority list.

NONPOINT SOURCE POLLUTION CONTROL PROGRAM

The Kentucky Nonpoint Source Management Program document provides a comprehensive description of Kentucky's strategy for controlling nonpoint source (NPS) pollution. It was prepared by the Division of Water (DOW) in response to the requirements of the Water Quality Act of 1987 and received full approval from the U.S. Environmental Protection Agency (EPA) in November, 1989. It describes those control measures, or best management practices (BMPs), which Kentucky will use to control pollution resulting from each NPS category (agriculture, construction, etc.) identified in the Kentucky NPS Assessment Report (and this report); the programs to achieve implementation of those BMPs; and a schedule for implementing those programs.

Because NPS pollution arises from a wide spectrum of diffuse sources throughout the Commonwealth, a variety of programs exists in a number of agencies which address NPS pollution control. The DOW serves as the lead oversight agency for these programs. Agencies and institutions cooperating in the implementation of Kentucky's NPS Management Program include the Kentucky Division of Conservation (DOC), Division of Forestry, Division of Waste Management, Division of Pesticides, and Department for Surface Mining Reclamation and Enforcement, Kentucky Conservation Districts, Kentucky Geological Survey, U.S. Soil Conservation Service (SCS), U.S. Agriculture Stabilization and Conservation Service (ASCS), U.S. Forest Service, U.S. Geological Survey, U.S. Army Corps of Engineers, Tennessee Valley Authority, University of Kentucky Water Resources Research Institute, and University of Kentucky College of Agriculture.

To help identify new directions for Kentucky's NPS Management Program, a NPS Advisory Committee was formed with representatives from government agencies having a role in NPS pollution control; the agriculture, construction, forestry, and mining industries; and private citizens and groups concerned with environmental protection interests. Most of the Advisory Committee's recommendations were incorporated into the program.

Monitoring

Nonpoint source pollution problems in the waters of the Commonwealth originate from land-based activities. The direct interrelationship between land activities and water quality necessitates that both the terrestrial and the aquatic environments are monitored and evaluated. To this end, the NPS Pollution Control Program has formed two on-site planning field teams. Each team consists of a DOW field team leader with an aquatic ecology background and a DOC field team member with an agronomy/agriculture background.

The actual collection, assessment, evaluation, and interpretation of both water quality and land-based data is the responsibility of the field teams. Physical characteristics of the waterbody, water chemistry, aquatic biological community structure, and land-based activities are different aspects of the waterbody's ecosystem that may be monitored. A multifaceted approach is necessary for NPS monitoring because of: (1) the mobility of NPS pollutants, (2) the varying degrees of pollutant toxicity, (3) the close interrelationship of land-based activities and NPS pollution, and (4) the spatial and temporal variabilities which exist in natural, dynamic ecosystems. Standard operating procedures (SOPs) specific for NPS monitoring activities are being developed for quality assurance and quality control. Nonpoint source SOPs will provide instruction and guidance in, and will ensure standardization of, study plan development, station location selection, water quality monitoring, land use/treatment monitoring, and weather monitoring. Additionally, field data sheets are being developed for improved reporting capabilities.

Water quality monitoring is an important aspect of the NPS program, especially: (1) where monitored water quality data is lacking, (2) where existing NPS pollution problems need to be quantified, and (3) where documentation is needed to show changes in water quality where alterations in land use practices have occurred. Monitoring will be conducted in priority watersheds and at demonstration projects.

Priority Watershed Monitoring Projects

Priority watersheds will be identified according to the prioritization process described in the Kentucky Nonpoint Source Management Program. The NPS field teams will conduct limited water quality monitoring in these priority watersheds, including but not limited to physicochemical and biological data. Some purposes for monitoring these watersheds are: (1) to identify or verify any nonpoint source pollution problem, (2) to determine if a waterbody is not supporting its designated uses as a result of NPS contamination, (3) to update the NPS Assessment Report, (4) to measure any changes in water quality, (5) to target areas for demonstration project implementation, and (6) to evaluate the prioritization process.

Demonstration Project: Turnhole Spring Groundwater Basin

Increasing public awareness of water quality problems at Mammoth Cave National Park has resulted in the development of the Mammoth Cave Karst Area Water Quality Oversight Committee. Its purpose is to achieve coordination among citizens, land users, and government agencies to monitor and improve the quality of waters in the karst area in south-central Kentucky.

A multi-agency technical committee consisting of representatives from local and state SCS offices, the ASCS, U.S. National Park Service, DOC, DOW, Kentucky Geological Survey, U.S. Geological Survey, Tennessee Valley Authority, University of Kentucky-College of Agriculture, Western Kentucky University-Department of Agriculture, and Western Kentucky University-Center for Cave and Karst Studies was established to work with the Mammoth Cave Karst Area Water Quality Oversight Committee in developing a nonpoint source water quality project for the Mammoth Cave area.

Turnhole Spring basin was targeted as the critical monitoring area within the Mammoth Cave drainage. Local SCS and ASCS representatives prioritized farms within Turnhole Spring basin for possible demonstration projects. Based on land resource needs, accessible water monitoring areas, and farmer cooperation, three farms were prioritized as demonstration farms. On each demonstration farm, best management practices will be implemented in a holistic, systems approach. Multi-agency monitoring efforts will be utilized to document agricultural impacts on the quality of surface waters, groundwaters, and wetlands, as well as to address cross-media interactions. DOW will be responsible for developing study plans for monitoring activities on demonstration farms; coordinating monitoring activities with other involved agencies; implementing water quality monitoring; and interpreting and documenting changes in water quality that relate to the implementation of BMPs. These demonstration farms will be used for agricultural education purposes.

Other Water Quality Projects

The NPS on-site planning field teams are also involved in other water quality projects. The team leaders provide technical assistance and limited monitoring for these projects, which are discussed below.

Upper Salt River/Taylorsville Reservoir Watershed

Fishery problems in Taylorsville Reservoir, including fish kills and reduced fish reproduction, have prompted multi-agency concern over the water quality in the Upper Salt River watershed. The U.S. Army Corps of Engineers, Kentucky Department of Fish and Wildlife Resources, and DOW have begun efforts to assess the fishery problems in the reservoir. The basin is being impacted from excessive nutrient and sediment loading from agricultural activities, municipal wastes, faulty septic systems, and other land use activities. A comprehensive study plan has been developed by NPS field team leaders, which describes the objectives and activities of agencies involved in water quality monitoring in the upper Salt River/Taylorsville Reservoir watershed. The NPS program proposed a study to determine the contribution of nonpoint source pollution from agricultural activities on the water quality of the upper Salt River. The NPS field teams have obtained and compiled various land use/cover/treatment data including, but not limited to, geology, pesticide usage, number of failing septic systems, number of dairies, and animal waste facilities in the watershed. In order to verify and update available land use/land cover data and to assist in selecting sampling stations, field reconnaissance of the watershed has been conducted by field team members and other DOW biologists. DOW biologists collected physicochemical and biological data as part of an intensive survey in the upper Salt River watershed. As part of the proposed study, stream flow was measured and water chemistry was sampled during three rain-events and one low flow period on the Salt River immediately upstream from Taylorsville Reservior. Sampling at eight additional locations is proposed for early 1990.

Upper Green River Watershed

The Concerned Citizens of Upper Green River for Better Water Quality has raised the public consciousness of water quality issues in the upper Green River watershed. In association with the SCS, this concerned citizen's group applied for, and received, a federal grant from the ASCS for implementing agricultural best management practices at a 75/25 percent cost share. The NPS teams have conducted county-level field reconnaissance with each SCS district conservationist to try to identify possible BMP installation sites and water quality sampling stations. Field reconnaissance was also conducted by NPS field teams in order to verify and update available land use/land cover data, and to assist in selecting sampling stations. The teams obtained and compiled various land use/cover/treatment data including, but not limited to, geology, pesticide usage, number of failing septic systems, number of dairies, and animal waste facilities in the watershed. Pre- and post-BMP monitoring, using a paired-watershed approach, will be conducted in order to document long-term effects of agriculture BMPs (especially nutrient management BMPs) on water quality. Pre-BMP low and normal flow condition water samples have been collected at each station. Additionally, pre-BMP biological data (fish, macroinvertebrates and algae) have been collected at each station. Additional pre-BMP data may be collected early in 1990.

Kentucky State University Farm Demonstration Project

The Kentucky State University (KSU) farm will soon be conducting a project to demonstrate and quantify the merits of soil and water conservation by integrating principles of sustainable agriculture into a whole-farm plan for limited-resource farmers. The demonstration program will integrate many principles of sustainable agriculture and soil and water conservation including reduced tillage, intensive grazing management, integrated pest management, and alternative crops. KSU requested technical assistance from the DOW concerning water quality monitoring, which was provided in early 1990. The initiation and maintenance of these systems will be videotaped to establish a library of instructional materials for farmers, small farm assistants, extension service personnel, and other interested people. This information will be available through the KSU on-farm media center and traditional channels. Farm tours and field days will also be planned.

Data Collection/Data Management

A necessary and important function of the NPS program is the collection and management of NPS-related information. The cooperative, multi-agency nature of the program prescribes the reliance upon, and utilization of, existing data such as land use classification statistics, baseline water quality values or best management practice evaluations. To this end a NPS document library has been developed. All NPS-related documents are cataloged, and pertinent data is entered on computer for future retrieval. In addition, a computer literature search service has been identified and utilized for accessing other scientific and technical information pertinent to the program. Further, several statewide databases have been identified and utilized, including county-specific fertilizer and pesticide databases.

Education

To a large extent, the implementation of BMPs to control NPS pollution in Kentucky relies upon voluntary adoption by those who manage the use of Kentucky's land resources. Therefore, education plays a vital role in Kentucky's NPS Management Program. NPS education programs inform land users and other Kentucky citizens about the causes, consequences, and solutions (BMP use) for the various types and sources of NPS pollution.

The DOW NPS program coordinates and supports a wide spectrum of NPS educational activities and programs. These programs are conducted by a number of cooperating agencies and institutions including the DOW, DOC, Division of Forestry, Division of Pesticides, local Conservation Districts, SCS, and the Kentucky Cooperative Extension Service. The DOW has provided program speakers for school classrooms, civic groups, trade organizations, and agency meetings. Additionally, exhibits and other educational materials have been provided for use in conferences, fairs, field days, and clean-up days.

The WATER WATCH program (described in another section of this report) has proven to be a particularly valuable channel for educating citizens about NPS water quality problems and solutions. The NPS program staff and the Water Watch coordinator are working to further expand WATER WATCH educational materials and programs to: (1) include more information on BMPs and NPS pollution control, (2) train participants to identify land use activities that are contributing to NPS pollution of their adopted waterbody, and (3) collect data about water quality, aquatic life, and aquatic habitat conditions.

Update of the Nonpoint Source Pollution Assessment Report

Section 319 of the Water Quality Act of 1987 required all states to complete and submit a statewide Nonpoint Source (NPS) Pollution Assessment Report to EPA. The NPS Assessment Report was an attempt to identify all waters contaminated by NPS pollution and the NPS categories contributing to the problem. Kentucky's report was completed and approved by EPA in January, 1989. EPA requires each state to update the report every year. An updated 1989 NPS Assessment Report can be obtained by contacting the DOW. Additionally, an update of the NPS Assessment Report is a part of the 305(b) reporting process. The assessment update will: (1) identify navigable waters impacted by NPS pollution, (2) detail changes that have occurred since the publication of the assessment in the 1988 305(b) Report, and (3) discuss NPS pollution in Kentucky's waters.

The NPS Pollution Assessment Report fulfills four requirements of Section 319 which are briefly summarized as follows:

1. Identify navigable waters which can not attain or maintain applicable water quality standards or goals and requirements of the Water Quality Act of 1987, without additional action to control NPS pollution.

2. Identify categories and subcategories of NPS pollution that affect waters identified in item 1.

3. Describe the process for identifying Best Management Practices (BMPs) and other measures to control NPS and to reduce such pollution to the "maximum extent practicable".

4. Identify and describe state and local programs for NPS control.

The discussion that follows relates to items 1. and 2. An example of the format used in Appendix D to identify NPS impacted waters is presented in Figure 1. Information contained in the appendix includes the waterbody code, waterbody name, NPS categories, parameters of concern, data sources, method of assessment, and designated uses not fully supported.

Figure 1. Data Table Organization for Nonpoint Source Impacted Waters

HYDROLOGIC CODE	STREAM NAME	N.P.S. CATEGORIES 1 2 3 4 5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED EVALUATED	USES NOT FULLY SUPPORTED
05100202-011	ROCKHOUSE CREEK	32 88 21 55 51	SED, MET, SO4, Cl	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH

Waterbody Name and Code

The identification of waters impacted by NPS pollution consists of the name of the principal stream, lake, wetland, or groundwater site. The code further delineates the water being assessed and has been indexed in a computer storage and retrieval system for easy access to information compiled for the waterbody.

NPS Category

The categories and subcategories of NPS pollution sources for each of the listed waters and their codes were established in EPA's guidance document for the preparation of the 1990 305(b) report. Refer to Appendix D for a listing of the codes and sources.

Additionally, the NPS categories were prioritized based on the severity of the NPS impact. Prioritized categories appear in numbered columns, indicating the relative severity of NPS impacts for a specific waterbody. Column one identifies the NPS impact of greatest concern.

Parameters of Concern

This information indicates the parameters which significantly contribute to the NPS impacts. These parameters include sediment, nutrients, bacteria, chemicals, pesticides, metals, etc. See Appendix D for a list of the parameters and their abbreviations.

Data Sources: Evaluated/Monitored

Information for Kentucky's NPS Assessment Report was gathered from many different sources. Both evaluated and monitored data were obtained and used to assess the NPS impacts to streams and lakes, wetlands, and groundwaters. Two levels of assessment were used to determine the impact of NPS pollution: monitored or evaluated. "Monitored" waters are those that have been assessed based on current site-specific water quality data. Waters were labeled as being "evaluated" if they were judged to be impacted by NPS pollution based on field observations, citizen complaints, fish kill reports, land use data, etc. Additionally, specific water quality data more than five years old were labeled as evaluated.

Seventeen different information sources were used to evaluate actual and potential NPS impacts to the streams and lakes of Kentucky. Most of the evaluated impacts were based on data obtained from a 1987 NPS survey. The survey requested the conservation district boards in each county to identify surface waters affected by NPS pollution, categories or subcategories of NPS pollution, land uses, and conservation practices. The survey provided information based on the conservation districts' best professional judgment and the technical expertise of field representatives from the SCS and the DOC. The survey had a 100 percent response. Information was also obtained from a NPS survey of private citizens and groups with a known interest in water quality. There were 85 responses including those from various groups and organizations such as County Health Departments, the ASCS, and representatives from the Kentucky Chapters of the National Audubon Society and the Sierra Club. Evaluated information was not based on data gathered through actual monitoring efforts. The information was considered valuable, however, because of the proximity of those providing the data to the actual NPS problems.

Monitored water quality data were also used for assessing NPS impacts to Kentucky's streams and lakes. The 1986 and 1988 305(b) reports are data sources frequently identified in the assessment tables providing monitored physicochemical and bacteriological data. Other sources of data for the assessment include DOW ambient water quality data (DOW-AMB), DOW intensive surveys (DOW-IS), Water Resources Data for Kentucky (USGS, 1980), Environmental Impact Statement, Yatesville Lake Project (ACOE, 1985), The Effects of Coal Mining Activities on the Water Quality of

Streams in Western and Eastern Coalfields of Kentucky (DOW, 1981), water quality data from the Ohio River Valley Sanitation Commission (ORSANCO, 1988-1989), water quality data from the University of Kentucky (UK, 1989), DOW biomonitoring water quality data (DOW-BM), DOW lake monitoring program (DOW-LAKES, 1988-89), DOW bacteriological studies (DOW-BACT), DOW fixed biological stations (DOW-BIO), other DOW water quality data (DOW and TN Tech, 1989) and additional monitored water quality data from the EPA.

The extent of NPS contamination of groundwaters has not been thoroughly researched or documented. Approximately 30 different information sources were used to assess groundwater impacts. Literature searches revealed several site-specific groundwater studies which provided both evaluated and monitored information. Much of the specific monitored groundwater data was more than five years old, and therefore was identified as evaluated in the Data Sources column. DOW's groundwater staff provided most of the evaluated data.

Twelve different information sources were used to assess NPS impacts on wetlands. The majority of these sources provided actual monitored data. Physicochemical data were collected and documented by several information sources noted as Bosserman (1985); Mitsch (1985, 1983, 1982); and the Kentucky State Nature Preserves Commission (NPC) (1982, 1981, 1980a, 1980b, 1979). Biological data were also collected by NPC personnel for several of the wetland systems. The biological monitoring included qualitative and quantitative analyses of algae, macroinvertebrates, and fish. The data were collected more than 5 years ago so it was identified as evaluated in the assessment tables. Other evaluated wetland information was provided by the Draft Environmental Impact Statement, Reelfoot Lake Water Level Management (USFW, 1988); 1987 Nonpoint Source Survey (NPS Survey, 1987); and the Division of Water (DOW, 1989).

Uses Not Fully Supported

Kentucky water quality regulations classify streams based on identifiable uses. The stream use classifications are: (1) Warmwater Aquatic Habitat (WAH), (2) Coldwater Aquatic Habitat (CAH), (3) Domestic Water Supply (DWS) (4) Primary Contact Recreation (PCR), (5) Secondary Contact Recreation (SCR), and (6) Outstanding Resource Waters (ORW). Uses in several waterbodies have been designated as threatened due to land-based activities in the area. Threatened use means that while a use or uses are fully supported in these waterbodies, NPS pollution arising from current land use activities in those watersheds could potentially make these waterbodies not support a use. The use classifications help protect public health and welfare, and protect and enhance the quality of water for aquatic life. Partial and nonsupport are not differentiated in the tables, but these support categories are reported separately in the streams and rivers, and lake assessment chapters in this report.

Surface and Groundwaters Impacted by Nonpoint Source Pollution

Rivers, Streams and Lakes

Nonpoint source pollution of Kentucky's rivers, streams, and lakes is widespread, occurring in virtually every county of the state. Agricultural activities are the major sources of NPS pollution in Kentucky, both in terms of statewide distribution and the severity of pollution within a given area or watershed. Sedimentation due to water erosion of disturbed land is the primary consequence of agricultural land use.

Sediment is the most common nonpoint source pollutant by volume in Kentucky. It can cause navigational and flooding problems, threaten aquatic life, and transport large amounts of other pollutant materials. For example, nutrients and pesticides, two additional major categories of agricultural NPS pollutants, bind to, and are transported along with, sediment particles to streams and lakes.

Crop production is the primary agricultural land use activity affecting water quality. Because of its widespread occurrence, pastureland, especially where poorly maintained, is the second most common source of agricultural NPS pollution. Nutrient loading and bacterial contamination from feedlots, animal holding, and other livestock management areas are commonly occurring and often critical NPS problems throughout the Commonwealth. Other sources of agricultural NPS pollution include streambank erosion from unrestrained livestock, irrigated crop production, and speciality crop production (truck farming).

Surface coal mining activities are the most extensive and critical sources of NPS pollution that impact the streams and lakes of the Eastern and Western Kentucky Coalfields. Underground coal mine activities are a common secondary source of NPS pollution in these regions. Other mining-related nonpoint pollution sources in the state include runoff from limestone quarries and abandoned fluorspar mines.

Sediment, acid mine drainage, and elevated iron and sulfate concentrations are the principal pollutants associated with surface and underground coal mining activities. Sedimentation arises from stripping operations, haul roads, spoil banks on unreclaimed abandoned mine areas, deforested areas, sediment retention structures which have failed or do not operate properly, and sometimes surface disturbances associated with areas permitted for deep mining. Abandoned mines, which include underground mines and surface mines abandoned illegally or before mining regulations took effect, generally contribute the most severe acid water problems. Impacts from limestone quarries generally involve slight downstream increases in siltation and alkalinity.

Petroleum extraction activities occur in several regions of the Commonwealth. Improper brine discharges from oil and gas drilling operations result in high chloride levels, which in some areas are severe enough to eliminate aquatic fauna and adversely affect downstream public water supplies. Sedimentation from improperly constructed and maintained oil and gas facility service roads is also of concern.

Sedimentation of streams and lakes frequently results from silvicultural activities, or activities related to use of forest lands. Erosion can result from logging operations, saw mill runoff, reforestation, residue management, forest fires, haul road construction and maintenance, and woodland grazing of livestock. NPS pollution from silvicultural operations is widespread in Kentucky and is of special concern in steeply sloping areas.

Sediment is the major pollutant arising from several other source categories of NPS pollution. Construction activities (residential, commercial, or highway) can expose bare soil, resulting in severe erosion and sedimentation. Hydrologic habitat modification activities such as dredging, channelization, and flow regulation/modification, can alter the stream flow, disturb adjacent land area, and cause streambank erosion. Streambank erosion can also be caused by unrestrained access for livestock and increased runoff from impervious surfaces in urban areas.

Nonpoint source pollutants other than sediment are carried by runoff from several different categories of sources into Kentucky's streams and lakes. Stormwater runoff from urban areas washes nutrients, pesticides, bacteria, petroleum products, and a broad spectrum of other toxic substances into streams and lakes. On-site wastewater system runoff, especially from malfunctioning septic tanks, carries bacteria and nutrients to waterbodies. Solid waste and sewage is another frequently occurring NPS pollution category. While garbage, refuse, and debris primarily clog watercourses and create aesthetic eyesores, they can also be a water quality problem because of pollutant residues remaining in the discarded containers and packaging. Finally, herbicides and other toxic substances which are used in highway and railroad right-of-way maintenance, discarded in landfills, or used in industrial land treatment, have been reported to pollute Kentucky's streams and lakes.

Appendix D presents an updated, comprehensive listing of Kentucky rivers, streams, and lakes impacted by NPS pollution. Both monitored and evaluated data were used to update the 1989 version of the Kentucky Nonpoint Source Pollution Assessment Report. In many cases, analysis of the updated information has resulted in changes to designated use support determinations. Compared to earlier determinations, a greater number of rivers, streams, and lakes are now reported to not fully support their designated uses because of nonpoint sources of pollution. This is because additional available data have enabled use support determinations to be made for more of the Commonwealth's waters.

The appendix consists of tables organized by the eight major Kentucky river basins and minor tributaries of the Ohio River. Impacted waters are identified by Waterbody System number. When comparing this updated report to earlier versions of the Kentucky Nonpoint Source Pollution Assessment Report, it is important to note that the earlier reports identified impacted waters by P.L.-566 watershed number, and that there is not a one-to-one correspondence between the Waterbody and P.L.-566 cataloging systems.

Wetlands

Kentucky possesses a diversity and abundance of wetland resources. The major wetlands are identified as riverine, palustrine, and lacustrine. Human activities which adversely impact wetlands include resource exploration and extraction, agriculture, hydrologic/habitat modification, silviculture, and construction. Resource extraction activities of some type probably affect more acres of wetlands in Kentucky than any other category. Nonpoint source pollutants such as acid mine drainage and sedimentation have adversely impacted the water quality, soil saturation time, and vegetation of these wetlands. Another resource extraction activity, petroleum exploration and extraction, also has a detrimental effect on wetlands. Oil well drilling often results in modifications to the existing drainage patterns, with subsequent changes in adjacent wetland ecosystems. Additionally, oil spillage and brine discharges from active oil wells adversely impact wetlands.

Historically, the conversion of wetlands for agriculture has resulted in substantial losses of wetland resources in the Commonwealth. In addition to direct wetland loss through conversion, agricultural nonpoint source runoff containing high concentrations of sediments, nutrients, and pesticides can potentially degrade wetland areas.

Riparian wetlands are impacted by hydrologic/habitat modifications such as channelization and flood control activities. Straightening channels for flood control can prevent the natural flooding of wetlands and subsequently reduce their mineral and organic nourishment. Constructed levees can cut off wetlands from floodplains or increase water levels, both of which alter the natural soil saturation period and can cause an adverse change in wetland functions.

Another threat to wetland resources is silvicultural activities. Timber harvesting is periodically desired on wetland areas with large stands of timber. However, logging operations typically result in soil compaction and sedimentation, resulting in wetland alteration and degradation.

Wetlands in Kentucky are also affected by construction activities. Land development, highway construction, and other construction related activities can result in both wetland conversion and nonpoint source pollutant loading to adjacent wetlands.

Groundwater

One of the most valuable resources in Kentucky is the state's extensive groundwater system. Groundwater is susceptible to nonpoint source (NPS) contamination. Karst regions, which comprise about 50 percent of the Commonwealth, are especially vulnerable. Approximately 48 of Kentucky's 120 counties are considered at high to moderate risk for groundwater contamination. The variety of geologic settings within Kentucky provide for significant local differences in the transport, accumulation, and breakdown of pollutants in the subsurface environment. The spatial variability of land uses also affects the distribution of pollutants in groundwater. Activities that can lead to groundwater contamination include agriculture, on-site sewage systems, waste disposal, resource exploration, development and/or extraction, improper well construction and operation, urban development, construction, underground injection of liquids, underground storage tank leakage, and spills.

Agricultural activities have a major impact on Kentucky's groundwater resources. Sedimentation is a common contaminant resulting from agricultural activities, especially in karst areas where sediment-laden streams sink into subterranean caverns. Other identified contaminants from agricultural activities are pesticides, nutrients, and bacteria. Some types of pesticides are soluble in water and are transported to aquifers by percolation of precipitation or by runoff from cropland. Excessive amounts of nitrates, nitrites, and bacteria can potentially render an aquifer useless. These contaminants may reach groundwater sources via percolation of precipitation through contaminated soil or runoff from animal feedlots, animal waste storage facilities, animal waste spreading operations, and sewage disposal systems.

Another major NPS impact to Kentucky's groundwater is improperly constructed or maintained onsite sewage disposal systems. Bacteria, nutrients, and potentially hazardous chemicals are the major parameters of concern. Leakage from these systems percolates through the soil into groundwater sources. Contamination of well water by onsite sewage systems can pose serious health problems to well users.

Contaminants such as PCBs, metals, bacteria, and hazardous chemicals are major parameters of concern in leachate and runoff from inadequately constructed or maintained solid or hazardous waste disposal facilities. In karst areas, the relatively rapid rate of contaminant transport through the soil into the aquifer results in the decreased ability of the soil to filter contaminants from the water. Where a leak occurs in a facility's liner, contamination could be swift and extensive. Runoff from such areas can potentially cause serious degradation problems in groundwater systems. Illegal dumping of wastes into sinkholes, along roadsides, or in secluded areas may also impact groundwater resources.

Resource exploration, development and/or extraction activities can cause regional NPS groundwater contamination problems. Petroleum extraction activities, such as the construction and operation of oil and gas wells, can cause groundwater contamination. Elevated concentrations of chlorides and total dissolved solids in groundwater are associated with brine contamination from oil and gas well drilling activities. Brine can enter the groundwater system directly during the well drilling process via improper underground reinjection, or as a result of waterflooding techniques commonly used for secondary petroleum recovery. Other parameters of concern from petroleum activities include metals and sulfates. Groundwater systems in Kentucky's coal regions are particularly vulnerable to NPS pollution impacts as well. The major parameters of concern regarding coal mining activities are elevated concentrations of metals and acid mine drainage. To a varying degree, groundwater quality near abandoned mines can be impacted by NPS contaminants. The Division of Abandoned Lands has had a significant number of requests from local governments for assistance in developing public water supplies where existing groundwater sources have been adversely impacted.

Urban areas and construction activities have been identified as sources of NPS contaminants of groundwater. In urban karst areas, groundwater is vulnerable to contamination by metals, bacteria, pesticides, and oil and grease from street runoff. Highly contaminated stormwater runoff can directly recharge groundwater through sinkholes used as auxiliary stormwater disposal facilities and sinking streams. Sediment is usually the major contaminant from construction activities.

Underground injection of liquid wastes, underground storage tanks, and spills are other NPS polluters of groundwater. Underground injection of liquid wastes will severely impact an aquifer if the substance is injected directly into the aquifer. The parameters of concern are dependent upon the identity of the injected liquid. Leaking underground storage tanks can also cause localized groundwater damage. Petroleum products can readily percolate into underlying aquifers. Spills of toxic materials can reach groundwater systems by percolation or surface water recharge. Contamination from a spill can cause major degradation of a groundwater source.

Not only does nonpoint source pollution affect the quality of groundwater used for drinking, it also threatens aquatic organisms. Subterranean river basins and aquifers provide a unique habitat for certain endangered and rare species. Three rare animal species, Amblyopsis spelaea (Northern cavefish), Typhlichthys subterraneus (Southern cavefish), and Palaemonias ganteri (Kentucky cave shrimp) are known to inhabit subterranean waters in Kentucky. Survival of these species is directly related to suitable groundwater quality in the Mammoth Cave region. The only known population of Palaemonias ganteri is found in the Mammoth Cave region. It is listed as a federally endangered species by the U.S. Fish and Wildlife Service, because it "is in danger of extinction throughout all or a significant portion of its range."

Oil and gas drilling presently occurs in several groundwater basins that supply Mammoth Cave. Brine from such activities commonly reaches aquifers potentially creating physicochemical changes in groundwater quality. Finally, agricultural activities resulting in sedimentation, excessive nutrients, and the introduction of pesticides into the groundwater can potentially impact rare cave species.

Appendix D identifies groundwater basins that are known to be impacted by nonpoint source pollution. They were assessed using both evaluated and monitored data.

Evaluated data was based on non-monitored water quality information provided by DOW groundwater staff and the U.S. Geological Survey. More baseline data are needed to effectively evaluate the extent of contamination present in Kentucky's groundwater.

SURFACE WATER MONITORING PROGRAM

An effective water monitoring program is essential for making sound pollution control decisions and for tracking water quality improvements. Specifically, Kentucky's ambient monitoring program provides monitoring data to identify priority waterbodies upon which to concentrate agency activities, to revise state water quality standards, to aid in the development of wasteload allocations, and to determine water quality trends in Kentucky surface waters. As outlined in the Kentucky Ambient Surface Water Monitoring Strategy, the major objectives associated with the Ambient Monitoring Program are:

1. To operate a fixed-station monitoring network meeting chemical, physical, and biological data requirements of the state program and EPA's Basic Water Monitoring Program (BWMP).

2. To conduct intensive surveys on priority waterbodies in support of stream use designations, wasteload allocation model calibration/verification, and other agency needs.

3. To store data in EPA's STORET system, a computerized water quality data base.

4. To coordinate ambient monitoring activities with other agencies (EPA, Ohio River Valley Water Sanitation Commission, U.S. Geological Survey, U.S. Army Corps of Engineers, etc.).

Following is a discussion on components of the monitoring program (fixed-station monitoring, biological monitoring, intensive surveys). Elements of the toxicity testing program relating to surface waters, and a citizen education program called WATER WATCH, which includes a monitoring element, are also discussed.

Fixed-Station Monitoring Network

Fixed-station stream water quality monitoring sites active during 1988-1989 are listed in Table 37. Locations of these sites are depicted in Figure 2. Excluding the mainstem of the Ohio River, data generated by this monitoring network were used to characterize approximately 1,500 stream miles within the state.

For the reporting period (1988-1989), the Division of Water's physicochemical network consisted of 45 stream stations located in ten river basins. Water samples collected monthly at each station were analyzed for the parameters shown in Table 38. In addition, the Division supports and uses data collected by the Ohio River Valley Water Sanitation Commission (ORSANCO) at five major tributary stations. The Division also uses data from stations maintained as part of the U.S. Geological Survey's current monitoring programs.

Table 37

Fixed- Station Stream Monitoring Network

Map No.	Station Name	RMI*	Location
1	Tug Fork-Kermit	35.1	KY 40
2	Levisa Fork-Paintsville	69.4	US 23
3	Levisa Fork-Pikeville	117.3	KY 1426
4	Little Sandy River-Argillite	13.2	KY 1
5	Tygarts Creek-Load	28.1	KY 7
6	Licking River-Sherburne	126.7	KY 11
7	North Fork Licking River-Lewisburg	50.4	KY 419
8	South Fork Licking River-Cynthiana	49.1	KY 36/356
9	Licking River - Salyersville	266.9	KY 30
10	Eagle Creek-Glencoe	21.5	US 127
11	Kentucky River-Frankfort	66.4	St. Clair St. Bridge
12	South Elkhorn Creek-Midway	25.3	US 62/421
13	Dix River-Danville	34.6	KY 52
14	Kentucky River-Camp Nelson	135.1	Old US 27
15	Red River-Clay City	21.6	KY 15
16	Red River-Hazel Green	68.5	KY 746
17	Kentucky River-Heidelberg	249.0	KY 399
18	North Fork Kentucky River-Jackson	304.5	Old KY 30
19	Middle Fork Kentucky River-Tallega	8.3	KY 708
20	South Fork Kentucky River-Booneville	12.1	KY 28
21	Salt River-Shepherdsville	22.9	KY 61
22	Pond Creek-Louisville	15.4	Manslick Rd. Bridge
23	Rolling Fork-New Haven	38.8	US 31E
24	Beech Fork-Maud	48.1	KY 55
25	Green River-Munfordsville	225.9	Upstream US 31W
26	Nolin River-White Mills	80.9	White Mill Bridge
27	Bacon Creek-Priceville	7.3	C. Avery Rd. Bridge
28	Barren River-Bowling Green	37.5	College St. Bridge
29	Green River-Cromwell	130.6	Ohio Co. Water Dist. Intake
30	Mud River-Lewisburg	44.5	KY 106
31	Pond River-Apex	62.8	KY 189
32	Pond River-Sacramento	12.4	KY 85
33	Rough River-Dundee	62.5	Davidson Rd. Bridge
34	Tradewater River-Olney	72.6	KY 1220
35	Cumberland River-Pineville	654.4	Pine St. Bridge
36	Cumberland River-Cumberland Falls	562.3	KY 90
37	Rockcastle River-Billows	24.4	Old KY 80
38	Horse Lick Creek-Lamero	7.5	Daugherty Road
39	Buck Creek-Eubank	45.0	KY 70
40	Big South Fork Cumberland River-Yamacraw	40.3	KY 92
41	Cumberland River-Burkesville	427.0	Allen St. Boat Dock
42	Little River-Cadiz	24.4	KY 272
43	Clarks River-Almo	53.5	Almo-Shiloh Rd. Bridge
44	Mayfield Creek-Magee Springs	10.8	KY 121
45	Bayou de Chien-Clinton	15.1	US 51

*RMI = Location in River Mile Index file

Fixed - Station Monitoring Network
Stream Station Locations

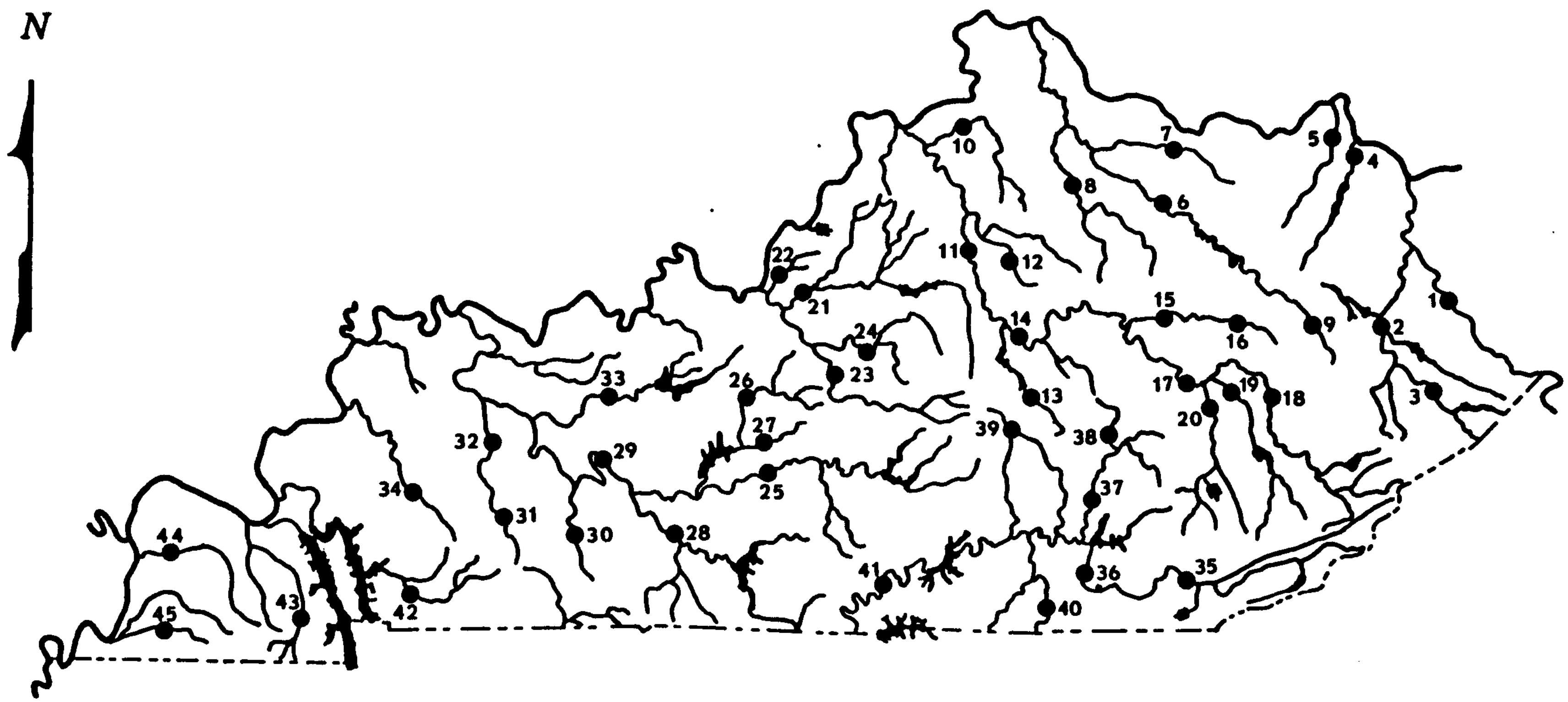

Figure 2

Table 38

Stream Fixed-Station Parameter Coverage
( ) STORET Parameter Code

Parameters	Parameters
Field Data	**Laboratory Data**
Weather code (47501)	Acidity, mg/l (00435)
Air temp, °C (00020)	Alkalinity, mg/l (00410)
Water temp, °C (00010)	BOD, 5-day, mg/l (00310)
Specific conductance uS/cm @ 25C (00094)	Chloride, mg/l (00940)
D.O., mg/l (00299)	Sulfate, dissolved mg/l (00946)
pH, S.U. (00400)	Suspended solids, mg/l (00530)
Turbidity, N.T.U. (82078)	TOC, mg/l (00680)
Flow, cfs (00060)	
Minerals, Total*	
Calcium, mg/l (00916)	
Magnesium, mg/l (00927)	**Metals, Total***
Potassium, mg/l (00937)	
Sodium, mg/l (00929)	Aluminum, ug/l (01105)
Hardness, mg/l (00900)	Arsenic, ug/l (01002)
	Barium, ug/l (01007)
Bacteria	Cadmium, ug/l (01027)
	Chromium, ug/l (01034)
Fecal coliform, colonies per 100 ml (31616)	Copper, ug/l (01042)
	Iron, ug/l (01045)
Nutrients	Lead, ug/l (01051)
	Manganese, ug/l (01055)
NH_3-N, mg/l (00610)	Mercury, ug/l (071900)
$NO_2 + NO_3$-N, mg/l (00630)	Zinc, ug/l (01092)
TKN, mg/l (00625)	
Total phosphorus, mg/l (00665)	

*Total as Total Recoverable

Lake monitoring was continued in 1988-1989 to address needs of two objectives. First, several lakes were sampled to evaluate problems of accelerated eutrophication. Second, three lakes were sampled to evaluate trends relating to potential acid precipitation impacts. Lakes in the ambient monitoring program are listed in Table 39, and the parameters measured are in Table 40. Embayments of Dale Hollow Lake were additionally monitored to determine if water quality was affected by tributary streams, which had elevated levels of chlorides and sulfates attributed to oil and gas production activities.

Table 39

Lake Ambient Monitoring Network

Lake	Station Location
Eutrophication Trend Lakes	
Reformatory	Dam
McNeely	Dam
Fish (1988 only)	Upper Lake Area
	Lower Lake Area
Barkley (1988 only)	Little River Embayment
Cumberland	Big Lily Creek Embayment
	Beaver Creek Embayment
Grayson	Dam*
	Upper Lake Area
Dewey	Dam*
Fishtrap	Dam*
	Upper Lake Area*
Nolin River (1988 only)	Dam
	Long Falls Creek Area
	Sportsman Paradise Area
	KY 88 Bridge Area
	Bacon Creek Area
Dale Hollow (1988 only)	Sulphur Creek Area
	Williams Creek Area
	Fanny's Branch Area
	Illwill Creek Area
	Little Sulphur Creek Area
	Spring Creek Area
Acid Precipitation Trend Lakes	
Tyner	Dam
Cannon Creek	Dam
Bert Combs	Dam

*Spring sampling to supplement Corps of Engineers sampling

Table 40

Lake Ambient Monitoring Parameters

Parameters	EUT[1]	ACP
Dissolved oxygen	X	
Temperature	X	
pH	X	X
Specific conductance	X	X
Depth of euphotic zone	X	
Acidity		X
Acid neutralizing capacity (Alkalinity)	X	X
T.[2] aluminum		X
Extractable aluminum		X
D.[3] Calcium		X
D. chloride		X
T. fluoride		X
D. fluoride		X
D. inorganic carbon		X
D. organic carbon		X
D. iron		X
D. magnesium		X
D. potassium		X
D. silica		X
D. sodium		X
D. sulfate		X
T. phosphorus	X	
T. soluble phosphorus	X	
Orthophosphate	X	
Ammonia-N	X	X
Nitrite & nitrate-N	X	
T. Kjeldahl-N	X	
Chlorophyll *a*	X	
Color		X

1 EUT - lake eutrophication evaluation
ACP - lake acid precipitation evaluation

2 Total

3 Dissolved

Biological Monitoring

Kentucky's biological monitoring program currently consists of a network of 40 stations in 12 river basins. Data collected from these stations are used to ensure that existing water quality is maintained, provide background values against which future water quality conditions can be compared, and recognize emerging problems in the areas of toxic residue, bacteriological contamination and nuisance biological growth. Program emphasis is directed at evaluating warmwater aquatic habitat (WAH) use support, determining presence and concentration of toxic residues in fish tissue and sediments, and evaluating municipal and industrial effluents for toxic conditions. The information from these monitoring efforts supports EPA's Basic Water Monitoring Program, provides information to state programs, and is used in developing the 305(b) report. For this report, biological data from 40 sites sampled from 1986-1989 were used to assess 1124.6 miles of streams for WAH use. Biological monitoring station locations and parameter coverage are outlined in Table 41.

Intensive Surveys

Kentucky uses the intensive survey to evaluate site-specific water quality problems. Information developed from intensive surveys are essential in providing information to:

- Document the attainment/impairment of designated water uses,
- Verify and justify construction grants decisions,
- Address issues raised in petitions for water quality standards variances, or use redesignations,
- Document water quality improvements and progress resulting from water pollution control efforts.
- Establish base-line biological data required for permit requirements and establishment of standards.

In 1988-1989, nine intensive surveys were conducted on 763.1 miles of streams. The locations, purposes, and conclusions of these surveys are summarized in Table 42. During the 1990-1991 fiscal year, at least six intensive surveys are planned. Table 43 lists the locations and the objectives of each survey.

Table 41
Biological Monitoring Station Locations and Sampling Coverage (1986-1989)

Station	U.S.G.S Hydrologic Unit No.	Algae	Macro-invertebrates	Fish	Fish Tissue	Sediments
Big Sandy River Basin						
Tug Fork	05070201	X	X			X
Levisa Fork (Paintsville)	05070203	X	X		X	X
Levisa Fork (Pikeville)	05070203	X	X		X	
Little Sandy River Basin						
Little Sandy River	05090104					X
Ohio River Tributaries						
Kinniconick Creek	05090201	X	X	X		X
Tygarts Creek	05090103	X	X	X	X	X
Licking River Basin						
North Fork Licking River	05100101	X	X			X
Licking River-Sherburne	05100101	X	X			X
Licking River-Salyersville	05100101	X	X	X	X	X
South Fork Licking River	05100102	X	X			X
Kentucky River Basin						
North Fork Kentucky River	05100201	X	X			X
Middle Fork Kentucky River	05100202	X	X			X
South Fork Kentucky River	05100203	X	X			X
Kentucky River, Lock 14	05100204	X	X			X
Red River (746 bridge)	05100204	X	X	X	X	X
Red River (Clay City)	05100204					X
Kentucky River, Camp Nelson	05100205	X	X		X	X
Kentucky R. below Frankfort	05100205	X	X		X	X
South Elkhorn Creek	05100205	X	X		X	X
Eagle Creek	05100205	X	X			X

Table 41 (Continued)

Station	U.S.G.S Hydrologic Unit No.	Algae	Macro-invertebrates	Fish	Fish Tissue	Sediments
Upper Cumberland River Basin						
Cumberland River	05130101	X	X			X
Rockcastle River	05130102	X	X	X	X	X
Horse Lick Creek	05130102	X	X			X
Green River Basin						
Nolin River	05110001	X	X	X	X	X
Bacon Creek	05110001	X	X	X		X
Green River (Munfordsville)	05110001	X	X			X
Green River (Morgantown)	05110003				X	
Barren River	05110002					X
Mud River	05110003	X	X		X	X
Rough River	05110004	X	X		X	X
Pond River	05110006	X	X	X	X	X
Salt River Basin						
Salt River (Shepherdsville)	05140102	X	X			X
Salt River (Glensboro)	05140102	X	X			X
Pond Creek	05140102	X	X			X
Beech Fork	05140103	X	X	X	X	X
Rolling Fork	05140103	X	X			X
Tradewater River Basin						
Tradewater River	05140205	X	X			X
Tennessee River Basin						
Clarks River	06040006	X	X		X	X
Mississippi River Basin						
Bayou de Chien	08010201	X	X			X
Mayfield Creek	08010201	X	X	X	X	X

X - indicates monitored parameters

Table 42
List of Intensive Surveys Conducted During FY 88 and 89

Hydrologic Unit Number/Stream	Purpose of Survey	Year Surveyed	Total Miles Assessed	Miles Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses	Conclusions
05070201 and 05070204	Determine recreational potential and identify reaches that violated Kentucky criteria for primary contact recreation.	1988	376.1	307.1		69.0	Water quality was acceptable for primary contact use in the Big Sandy, Tug Fork and Levisa Fork rivers. Elkhorn Creek and Russell Fork water quality was not acceptable.
05130205 Little River (Lower Cumberland River Basin)	Determine the impact of nonpoint source pollution from an intensely farmed watershed.	1988	132.2	0	132.2	0	The aquatic life of the Little River and its major tributaries has been impacted by nonpoint source agricultural pollution.
Donaldson Ck. (Lower Cumberland River Basin)	Served as a control stream in the Little River study.	1988	14.2	14.2	0	0	Donaldson Creek is a good quality stream system.
05130104 Rock Creek (Upper Cumberalnd River Basin)	Determine the effect of clear cutting activities in the headwaters and abandoned land acid mine pollution in the lower portion of the drainage.	1988	24.0	18.0	0	6.0	The upper 18 miles of Rock Creek support an exceptional diversity of aquatic life, while White Oak Creek and the lower four miles of Rock Creek are severely impacted by acid mine drainage from abandoned lands.

Table 42 (Continued)

Hydrologic Unit Number/Stream	Purpose of Survey	Year Surveyed	Total Miles Assessed	Miles Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses	Conclusions
05130101 Yellow Creek (Upper Cumberland River Basin).	Determine if the operation of the new Middlesboro wastewater treatment plant has improved the water quality of Yellow Creek.	1988	49	22.5	26.5	0	The aquatic community found in Yellow Creek below the Middlesboro Wastewater Treatment Plant has improved. Coal mining is still impacting the basin. Clear Fork is included in the assessment (8.1 mi) as evaluated.
05140102 Salt River Basin)	Determine the nonpoint source pollution impact to the upper Salt River basin (above Taylorsville Reservoir)	1989	130.7	130.7	0	0	The upper Salt River system has considerable agricultural activities taking place; however, the stream system is still able to support designated uses.
*05100205 Cedar Brook (Kentucky River Basin)	To determine if the water quality of the Cedar Brook system improved after the elimination of an industrial waste discharge.	1988	7	4.5	2.5	0	The stream has been and is continuing to recover after the elimination of the industrial waste discharge.
*Elk Lick Creek (Kentucky River Basin)	Determine the impact to a small stream system from a chlorinated discharge from a water supply treatment plant and nonpoint runoff from a gravel quarry operation.	1989	3.9	2.0	1.9	0	When the survey was initially conducted, 1.4 miles of the stream system was not supporting WAH use because of the chlorinated discharge. Gravel from the quarry embedded 1.5 miles of stream channel. After

Table 42 (Continued)

Hydrologic Unit Number/Stream	Purpose of Survey	Year Surveyed	Total Miles Assessed	Miles Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses	Conclusions
							the chlorinated discharge was eliminated the stream was resurveyed and found to be recovering.
05100204 Millers Creek (Kentucky River Basin)	Determine if there has been improvement in water quality after the implementation of the state's chloride criteria to control brine pollution from petroleum activities	1989	26.0	0	0	26	Even though the water quality in this basin has improved, it has not improved enough to support a diverse community of aquatic life.

*Stream Not Shown on USGS Hydrologic Unit Map

Table 43
Proposed Intensive Surveys of the Kentucky Division of Water for FY 90

Hydrologic Unit Number/ Stream	Objective	Type of Study
05100205 South Elkhorn Creek (Kentucky River Basin)	To assess water quality trends since upgrade of Lexington Main WWTP. Followup of 1981 DOW survey.	Full Intensive Survey
05100205 Eagle Creek (Kentucky River Basin)	To acquire baseline water quality and biological data prior to future industrial and urban development.	Full Intensive Survey
05090104 Little Sandy River (Little Sandy Basin)	To acquire baseline water quality and biological data prior to possible future industrial and urban development.	Full Intensive Survey
05100201 North Fork Kentucky River (Kentucky River Basin)	To follow up previous study of nonsupport of recreational uses (1988 305(b)) and possible issuance of advisories.	Bacteriological Survey
05100102 Stoner Creek (Licking River Basin)	Verify WLA model assumptions below Paris WWTP.	WLA Model Calibration/ Verification study.
05140101 Harrods Creek (Ohio River Basin)	Verify WLA model assumptions in lower Harrods Creek, which receives numerous discharges from municipal and package plant WWTP's.	WLA Model Calibration/ Verification study.

Toxicity Testing

The Commonwealth of Kentucky has enacted several regulations for the protection of aquatic life in receiving waters. These regulations, for the most part, are based on setting effluent limitations for individual chemicals. However, toxicity data are available for only a limited number of compounds. The use of single parameter protection criteria, therefore, does not provide adequate or correct protection of aquatic life in certain situations where: the toxicity of the components in the effluent or surface waters is not known; there are synergistic (greater than predicted), additive, or antagonistic (less than predicted) effects between toxic substances in the tested media; or a complete chemical characterization of the water has not been carried out. Since it is not economically feasible to determine the toxicity of each of the thousands of potentially toxic substances in surface waters or point-source effluents, the most direct and cost-effective approach is whole-effluent or surface water analysis of toxicity in a standard bioassay.

Assessment of the extent, presence, and control of toxic conditions in the waters of the Commonwealth has relied on chemical specific and whole-effluent monitoring for municipal and industrial discharges under the Kentucky Pollution Discharge Elimination System (KPDES) permit process, compliance biomonitoring on those point-source dischargers, and toxicity testing of sediments and surface waters associated with intensive surveys. Under the KPDES permitting program, most major industrial and municipal facilities, and a number of minor facilities discharging priority pollutants, will be required to conduct toxicity testing (acute or chronic) on their final effluent(s).

During 1988-89, acute and chronic toxicity tests were conducted by the Division of Water on 54 point source discharges and on instream locations above and below those sources. Stream miles acutely impacted by point and nonpoint source pollutants totalled 174.2 miles. Impacts assessed by river basin are listed in Table 44.

Table 44
Stream Miles Impacted By Toxic Discharges
Based on the Results of Toxicity Tests

Basin	Stream(s) Affected	Miles Impacted	Probable Cause(s)
Green River	Valley Creek	5.5	Chlorine
	Black Lick Creek	12.2	Cu, Hg, Zn
	Three Lick Fork	1.1	BOD, Ammonia, Cu
	Flat Creek	4.1	Chlorine,
	Taylor Fork	1.0	BOD, Zn
	Total	23.9	
Kentucky	Lane's Run	0.6	Ag
	Kentucky River	13.3	Nonpoint
	Town Creek	6.6	Chlorine, Zn, Nonpoint
	Total	20.5	
Licking River	Slate Creek	6.4	Nonpoint
	Total	6.4	
Cumberland River	Whitley Branch	1.0	Chlorine
	Big Lily Creek	2.9	Chlorine, BOD, Chloride, Cu
	Eddy Creek	1.9	Chlorine, Cu, Ni
	Total	5.8	
Tennessee River	Bee Creek	0.7	Chlorine, BOD, Zn
	Total	0.7	
Salt River	Spring Ditch	0.1	BOD
	Hammond Creek	5.6	Cu, Zn
	Rowan/Town Creeks	2.6	Nonpoint, Chlorine
	Mill Creek	13.3	Nonpoint
	Road Run Creek	3.5	Nonpoint
	Hardins Creek	6.6	Chlorine
	Clear Creek	8.9	Chlorine
	Salt River	14.2	Nonpoint
	Salt River	20.4	Nonpoint
	Salt River	11.8	Chlorine
	Chenoweth Run	2.5	Chlorine
	Total	89.5	

Table 44 (Continued)

Basin	Stream(s) Affected	Miles Impacted	Probable Cause(s)
Mississippi River	Harris Fork Creek	2.1	Chlorine, Cd, Zn
	Mayfield Creek	1.2	Nonpoint, BOD, Ammonia, Zn
	Total	3.3	
Ohio River	Thrasher Creek	2.6	BOD, Volatile Organics
	Gunpowder Creek	0.3	Chlorine, Mn
	Crooked Creek	17.5	BOD
	West Ditch	1.0	BOD, Cyanide, TSS, TDS, Al, Cu, Fe, Ni, Zn
	Ohio River	0.1	Nonpoint, BOD, Al, Fe, Zn
	Ohio River	0.1	Al, Fe, Zn
	Ohio River	0.5	Nonpoint, Al, Fe, Zn
	Hite Creek	2.0	BOD
	Total	24.1	
	State Total	174.2	

Citizens Water Watch Program

The Kentucky WATER WATCH program is administered by the Natural Resources and Environmental Protection Cabinet's Division of Water. Launched in 1985, WATER WATCH promotes individual responsibility for a common resource, educates Kentuckians about the wise use and protection of local water resources, provides a recreational opportunity through group activities, and gives citizens more access to their government. Objectives include: **promoting individual responsibility** for a common resource by fostering a public role in drawing attention to specific problem situations; **enhancing citizen understanding and support** through a strong program of public education; and **communicating the value of environmental quality** in attracting industry and tourism to the state. The Division of Water promotes the program by encouraging citizens to form groups which "adopt" waterbodies of local interest.

After a group is formed, members identify the stream, lake or wetland they want to adopt and submit an "adoption" form for approval to the Division of Water. After the adoption is approved, the WATER WATCH group then promotes community awareness and protection of their adopted water resource through stream monitoring, school based programs, and stream rehabilitation projects.

Each group receives training from the Division's program coordinator and educational resources. The latter include a WATER WATCH Program Manual and two field guides (A Field Guide to Kentucky's Lakes and Wetlands and A Field Guide to Kentucky's Rivers and Streams).

Since its beginning, over 270 groups have been established with more than 800 members statewide, and over 20,000 people have received an overview presentation telling them about the program. Two hundred and fifty streams, 25 lakes, 30 wetlands and nine karst or underground systems have been adopted. Over 100 basic training workshops have been held in conjunction with the program statewide. Advanced training workshops for volunteers are also offered from time to time.

Volunteer Stream Sampling Project

The WATER WATCH Program initiated a Volunteer Stream Sampling Project in 1987. The objectives were: (1) to assist local groups in developing information concerning the quality of water resources close to them, (2) to gather information about stream segments not covered by the existing Kentucky Ambient Water Quality Monitoring Network, and (3) to educate the public about the condition and importance of Kentucky's water resources.

To date, the project has recruited over 54 volunteer teams consisting of over 300 volunteers to conduct regular water quality tests on streams in their communities. Although the information obtained cannot be used in enforcement action, citizen monitoring can and has provided useful "flagging" of water quality problems. Remedial action has occurred as a result of these efforts.

The teams are equipped with commercial water testing kits for measuring dissolved oxygen, pH, temperature, nitrate-nitrogen, ortho-phosphate, sulfate, iron and chloride. Volunteers are trained in testing and reporting procedures, quality control, and how to interpret results. Training also involves discussing ways the information can be shared through various organizations and media outlets.

Recruited groups have agreed to perform monthly tests on at least two designated sites in their community for one year. The volunteers submit the results to the Division, usually within one week after the tests are performed. The results are tabulated, summarized, and reported back to the groups.

The project is producing site data from 89 stations on streams in seven of Kentucky's 12 major river basins. The program is administered on a continuing basis by the WATER WATCH Program Coordinator at the Division of Water as a part of the overall WATER WATCH Program. New sites are being added continuously. Local groups, civic organizations, schools, and businesses contribute to the project.